MATHEMATICS-X

MODULE-2

INDEX

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PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

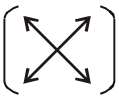
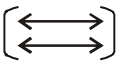
BASIC CONCEPTS AND IMPORTANT RESULTS

Linear equation : An equation of the form $ax + by + c = 0$ where a, b, c all are real coefficients and $a \neq 0$, $b \neq 0$ numbers is known as a linear equation in two variables x and y. Its graph is always a straight line.

Solution : A pair of values of x and y which satisfy the equation $ax + by + c = 0$ ($a \neq 0$, $b \neq 0$, and a, b, c are real numbers) is called a solution of the equation.

System of simultaneous linear equations : A pair of linear equations in two variables $a_1x + b_1y = c_1$, $a_2x + b_2y = c_2$ is said to form a system of simultaneous linear equations
where a_1, b_1, c_1 a_2, b_2, c_2 are all real number and $a_1^2 + b_1^2 \neq a_2^2 + b_2^2 \neq 0$.
A pair of values of x and y which satisfy each of the equations is called a solution or root of the system. If the system has at least one solution, it is called consistent and if the system has no solution, it is called inconsistent.

Conditions for consistency and inconsistency of a solution : Let the system of equations in two variables is : $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$

Conditions	Graphical representation	Algebraic representation	Conclusion
If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Two intersecting lines meet at a unique point 	The system has unique solution	Consistent
If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Two parallel lines 	The system has no solution	Inconsistent
If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Two coincident lines	The system has infinitely many solutions	Consistent

Methods of solving simultaneous linear equations in two variables :
(i) Algebraic Method **(ii) Graphical Method**
(i) Algebraic Method

(a) Method of substitution : Let the system of equations is :

$a_1x + b_1y = c_1$ .....(i)
$a_2x + b_2y = c_2$ .....(ii)

From (i), $y = \frac{c_1 - a_1x}{b_1}$

Substituting the value of y in (ii), we get: $a_2x + \frac{b_2}{b_1}(c_1 - a_1x) = c_2$

$\Rightarrow b_1a_2x + b_2c_1 - b_2a_1x = b_1c_2 \quad \Rightarrow (b_1a_2 - b_2a_1)x = b_1c_2 - b_2c_1$

$\Rightarrow x = \frac{b_1c_2 - b_2c_1}{b_1a_2 - b_2a_1}$

Similarly, substituting the value of x in (iii), we can get the value of y.

(b) Method of elimination : Let the system of equation is :

$a_1x + b_1y = c_1$ .....(i) $\quad a_2x + b_2y = c_2$ .....(ii)

Multiply the equations by a suitable non-zero number so as to make the coefficients of one variable equal.

Multiplying (i) by b_2 and (ii) by b_3, we get:

$a_1b_2x + b_1b_2y = c_1b_2$ .....(iii)

$a_2b_1x + b_1b_2y = c_2b_1$ .....(iv)

On subtracting, we get $x(a_1b_2 - a_2b_1) = c_1b_2 - c_2b_1 \quad \Rightarrow x = \dfrac{c_1b_2 - c_2b_1}{a_1b_2 - a_2b_1}$ .....(v)

Substituting the value of x in equation (i) or (ii), we can get the value of y.

(c) Method of cross-multiplication : Let the system of equations is :

$a_1x + b_1y + c_1 = 0$ .....(i) $a_2x + b_2y + c_2 = 0$ .....(ii)

$$\begin{array}{ccccc} x & & y & & 1 \\ b_1 & \times & c_1 & \times & a_1 \\ b_2 & & c_2 & & a_2 \end{array} \quad \begin{array}{c} \\ b_1 \\ b_2 \end{array}$$

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

From the above expression, we can get values of x and y.

(ii) Graphical Method

Let the system of equation is $l_1x \equiv a_1x + b_1x = c_1$ .....(i)

$l_2x \equiv a_2x + b_2x = c_2$ .....(ii)

(i) and (ii) are two intersecting straight lines, if $\dfrac{a_1}{a_2} \neq \dfrac{b_1}{b_2}$.

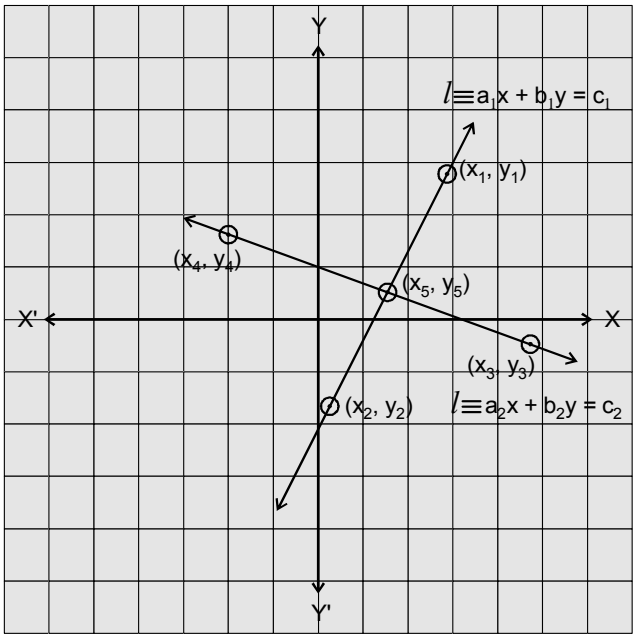
With the help of a graph paper, we draw both the lines on the graph.

$y = \dfrac{c_1 - a_1x}{b_1}$, Table 1

x	x_1	x_2
y	y_1	y_2

$y = \dfrac{c_2 - a_2x}{b_2}$ Table 2

x	x_3	x_4
y	y_3	y_4



Point of intersection of l_1 and l_2 is P whose position is (x_5, y_5).

$\therefore$ $x = x_5$, $y = y_5$ is the solution of given simultaneous equations.

Points to Remember :

(i) Equation of x -axis is y = 0 and equation of y-axis is x = 0 .

(ii) x = k is a straight line parallel to y-axis and y = k is a straight line parallel to x-axis.

(ii) y = kx is a straight line passing through (0, 0).

SOLVED PROBLEMS

Ex.1 Aftab tells his daughter, "Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be". (Isn't this interesting?) Represent this situation algebraically and graphically.

Sol. Let the present age of Aftab's daughter = x years.

and the present age of Aftab = y years (y > x)

According to the given conditions

Seven years ago, $(y - 7) = 7 \times (x - 7)$

i.e., $y - 7 = 7x - 49$

i.e., $7x - y - 42 = 0$ ...(i)

Three years later, $(y + 3) = 3 \times (x + 3)$

i.e., $y + 3 = 3x + 9$

i.e., $3x - y + 6 = 0$ ...(ii)

Thus, the algebraic relations are $7x - y - 42 = 0$, $3x - y + 6 = 0$.

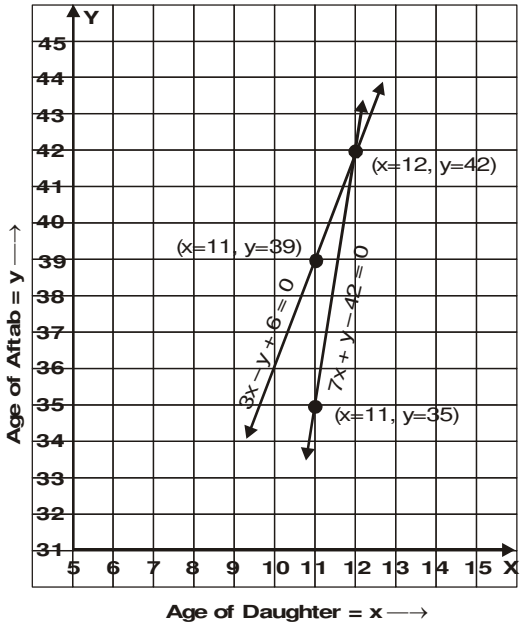
Now, we represent the problem graphically as below :

$7x - y - 42 = 0$ ...(i)

Age of Aftab's daughter	11	12
Age of Aftab = y = 7x – 42	35	42

$3x - y + 6 = 0$ ...(ii)

Age of Aftab's daughter	11	12
Age of Aftab = y = 3x + 6	39	42



From the graph, we find that x = 12

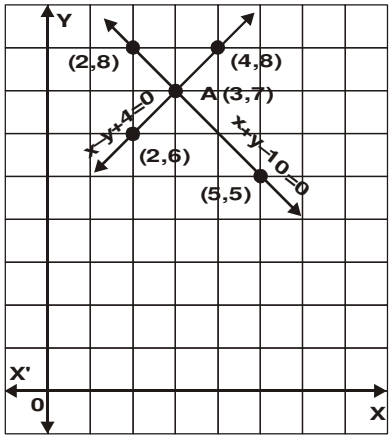
and y = 42

Thus, the present age of Aftab's daugther = 12 years

and the present age of Aftab = 42 years

Ex.2 Form the pair of linear equations in the following problems, and find their solutions graphically.
(i) 10 students of class X took part in a Mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls who took part in the quiz.
(ii) 5 pencils and 7 pens together cost Rs. 50, whereas 7 pencils and 5 pens together cost Rs. 46. Find the cost of one pencil and that of one pen.

Sol. (i) Let the number of boys be x and the number of girls be y.
According to the given conditions
$x + y = 10$ and $y = x + 4$
We get the required pair of linear equations as
$x + y - 10 = 0, x - y + 4 = 0$
Graphical Solution
$x + y - 10 = 0$ ...(i)



x	2	5
y = 10 – x	8	5

$x - y + 4 = 0$ ...(ii)

x	2	4
y = x + 4	6	8

From the graph, we have : x = 3, y = 7 common solution of the two linear equations.
Hence, the number of boys = 3 and the number of girls = 7. **(Rest Try Yourself)**

Ex.3 On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the lines representing the following pairs of linear equations intersect at a point, are parallel or coincident.
(i) $5x - 4y + 8 = 0$; $7x + 6y - 9 = 0$
(ii) $9x + 3y + 12 = 0$; $18x + 6y + 24 = 0$
(iii) $6x - 3y + 10 = 0$; $2x - y + 9 = 0$

Sol. (i) $5x - 4y + 8 = 0$ ...(i)
$7x + 6y - 9 = 0$ ...(ii)

$$\frac{a_1}{a_2} = \frac{5}{7}, \frac{b_1}{b_2} = \frac{-4}{6} = -\frac{2}{3}$$

$$\Rightarrow \quad \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$\Rightarrow$ Lines represented by (i) and (ii) intersect at a point. **(Rest Try Yourself)**

Ex.4 On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ **and** $\frac{c_1}{c_2}$, find out whether the following pairs of linear equations are consistent, or inconsistent.

(i) $3x + 2y = 5;\ 2x - 3y = 7$ (ii) $2x - 3y = 8;\ 4x - 6y = 9$

(iii) $\frac{3}{2}x + \frac{5}{3}y = 7;\ 9x - 10y = 14$ (iv) $5x - 3y = 11;\ -10x + 6y = -22$

(v) $\frac{4}{3}x + 2y = 8;\ 2x + 3y = 12$

Sol. (i) $3x + 2y - 5 = 0$ ...(i)

$2x - 3y - 7 = 0$ ...(ii)

$\frac{a_1}{a_2} = \frac{3}{2}, \frac{b_1}{b_2} = \frac{2}{-3} = -\frac{2}{3} \Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\Rightarrow$ The equations have a unique solution.

Hence, consistent. **(Rest Try Yourself)**

Ex.5 Find atleast three solutions for each of the following linear equations in two variables:

(i) $x + y + 4 = 0$ (ii) $5x + 3y = 4$

Sol. (i) $x + y + 4 = 0$

If $x = 0$, then $0 + y + 4 = 0 \Rightarrow y = -4$ So, $(0, -4)$ is a solution.

If $x = 1$, then $1 + y + 4 = 0 \Rightarrow y = -5$ So, $(1, -5)$ is a solution.

If $x = -1$, then $-1 + y + 4 = 0 \Rightarrow y = -3$ So, $(-1, -3)$ is a solution.

We can display the above solutions is the form of a table given below :

x	0	1	−1
y	−4	−5	−3

(ii) $5x + 3y = 4$

If $x = 2$, then $5(2) + 3y = 4 \Rightarrow 3y = 4 - 10 \Rightarrow 3y = -6 \Rightarrow y = -2$ So, $(2, -2)$ is a solution.

If $x = -1$, then $5(-1) + 3y = 4 \Rightarrow y = 4 + 5 \Rightarrow 3y = 9 \Rightarrow y = 3$ So, $(-1, 3)$ is a solution.

If $x = 5$, then $5(5) + 3y = 4 \Rightarrow 3y = 4 - 25 = -21 \Rightarrow y = -7$ So, $(5, -7)$ is a solution.

We can display the above solutions in the form of a table given below :

x	−1	2	5
y	3	−2	−7

Ex.6 Solve : $\frac{1}{2(2x+3y)} + \frac{12}{7(3x-2y)} = \frac{1}{2}$ and $\frac{7}{2x+3y} + \frac{4}{3x-2y} = 2$ where $2x + 3y \neq 0$ and $3x - 2y \neq 0$

Sol. Let $\frac{1}{2x+3y} = u$ and $\frac{1}{3x-2y} = v$, Then, the given system of equations becomes

$\frac{1}{2}u + \frac{12}{7}v = \frac{1}{2} \Rightarrow 7u + 24v = 7$ ...(i)

And $7u + 4v = 2$ ...(ii)

Subtracting (ii) from (i), we get : $20v = 5 \Rightarrow v = \frac{1}{4}$

Putting, $v = \frac{1}{4}$ in (i), we get : $7u + 6 = 7 \Rightarrow u = \frac{1}{7}$

Now, $u = \frac{1}{7} \Rightarrow \frac{1}{2x+3y} = \frac{1}{7} \Rightarrow 2x + 3y = 7$ ...(iii)

And, $v = \frac{1}{4} \Rightarrow \frac{1}{3x-2y} = \frac{1}{4} \Rightarrow 3x - 2y = 4$ ...(iv)

Multiplying (iii) by 2 and (iv) by 3, we get : $4x + 6y = 14$ ...(v),

$9x - 6y = 12$ ...(vi)

Adding (v) and (vi), we get : $13x = 26 \Rightarrow x = 2$

Puting $x = 2$ in (v), we get : $8 + 6y = 14 \Rightarrow y = 1$ Hence, $x = 2, y = 1$ is the solution of the given system.

Ex.7 Solve : 101x + 99y = 499 and 99x + 101 y = 501,

Sol. The given system of equations is 101x + 99y = 499 ...(i),

99x + 101 y = 501 ...(ii)

Adding (i) and (ii), we get : 200x + 200 y = 1000

$\Rightarrow$ $x + y = \frac{1000}{200}$ or $x + y = 5$ ...(iii)

Now, subtracting (ii) from (i), we get : 2x – 2y = –2

$\Rightarrow$ $x - y = -1$ ...(iv)

Adding (iii) and (iv), we get : $2x = 4 \Rightarrow x = 2$

Substituting x = 2 in (iii), we get : $2 + y = 5 \Rightarrow y = 3$

Hence, x = 2, y = 3 is the solution.

Ex.8 Solve : $a(x + y) + b(x-y) = a^2 - ab + b^2$ and $a(x + y) - b(x-y) = a^2 + ab + b^2$

Sol. The given equations may be written as : $a(x + y) + b(x-y) - (a^2 - ab + b^2) = 0$ ...(i)

$a(x + y) - b(x-y) - (a^2 + ab + b^2) = 0$ ...(ii)

Using cross-multiplication method, we get:

$$\frac{x+y}{b \quad -(a^2-ab+b^2)} = \frac{x-y}{-(a^2-ab+b^2) \quad a} = \frac{1}{a \quad b}$$

$-b$ $--(a^2+ab+b^2)$ $--(a^2+ab+b^2)$ a a $-b$

$$\Rightarrow \quad \frac{x+y}{\left[-b(a^2+ab+b^2)-b(a^2-ab+b^2)\right]} = \frac{1}{[a(-b)-ab]} \text{ and } \frac{x-y}{\left[-a(a^2-ab+b^2)+a(a^2+ab+b^2)\right]}$$

$$= \frac{1}{[a(-b)-ab]}$$

or $$\frac{x+y}{-2a^2b-2b^3} = \frac{x-y}{2a^2b} = \frac{1}{-2ab} \quad \therefore \quad x + y = \frac{-2a^2b-2b^3}{-2ab} = \frac{-2b(a^2+b^2)}{-2ab} = \frac{a^2+b^2}{a}$$

And, $x - y = \frac{2a^2b}{-2ab} = -a$ Thus, $x + y = \frac{a^2+b^2}{a}$ and $x - y = -a$

Adding (iii) and (iv), we get : $2x = \frac{a^2+b^2}{a} - a = \frac{b^2}{a}$ or $x = \frac{b^2}{2a}$

Subtracting (iv) from (iii), we get : $2y = \frac{a^2+b^2}{a} + a = \frac{(b^2+2a^2)}{a}$ or $y = \frac{(b^2+2a^2)}{2a}$

Hence, $x = \frac{b^2}{2a}$, $y = \frac{b^2+2a^2}{2a}$

Ex.9 For what value of k will the equations (k – 3) x + 3y = k, kx + ky = 12 represent coincident lines?

Sol. The given system of equations (k – 3)x + 3y – k = 0 and kx + ky – 12 = 0

It is of the form : $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Where, $a_1 = k - 3$, $b_1 = 3$, $c_1 = -k$ and $a_2 = k$, $b_2 = k$, $c_2 = -12$

The given equatins will represent conincident lines, if they have infiniely many solutions.

The condition for which is $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ ie. $\frac{k-3}{k} = \frac{3}{k} = \frac{-k}{-12}$ $\Rightarrow \frac{k-3}{k} = \frac{3}{k}$

and $\frac{3}{k} = \frac{-k}{-12}$

$\Rightarrow$ $k_2 - 3k = 3k$ and $k^2 = 36$ $\Rightarrow k^2 - 6k = 0$ and $k^2 = 36$

$\Rightarrow$ $k(k - 6) = 0$ and $k = \sqrt{36}$ $\Rightarrow (k = 0 \text{ or } k = 6)$ and $(k = \pm 6)\ k = 6$

Hence, the given equations represent coincident lines, when k = 6.

Ex.10 Which of the following pairs of linear equations are consistent/inconsistent? If consistent, obtain the solution graphically :

(i) $x + y = 5, 2x + 2y = 10$ (ii) $x - y = 8, 3x - 3y = 16$

(iii) $2x + y - 6 = 0, 4x - 2y - 4 = 0$ (iv) $2x - 2y - 2 = 0, 4x - 4y - 5 = 0$

Sol. (i) $x + y = 5$ ...(i)

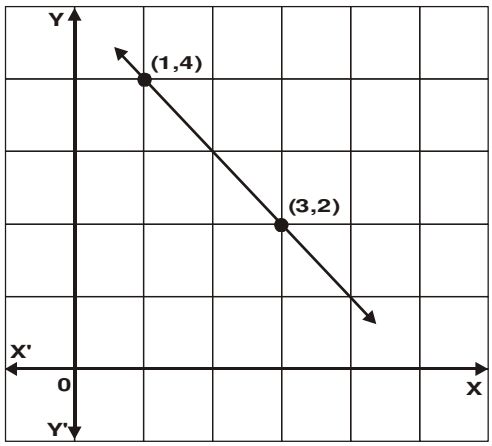
$2x + 2y = 10$ ...(ii)

$$\frac{a_1}{a_2} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{-5}{-10} = \frac{1}{2}$$

i.e., $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Hence, the pair of linear equations is consistent.

(i) and (ii) are same equations and hence the graph is coincident straight line.



x	1	3
y = 5 – x	4	2

(Rest Try Yourself)

Ex.11 Given the linear equation $2x + 3y - 8 = 0$, write another linear equation in two variables such that the geometrical representation of the pair so formed is :

(i) Intersecting lines (ii) Parallel lines (iii) Coincident lines

Sol. (i) $2x + 3y - 8 = 0$ (Given equation)

$3x + 2y + 4 = 0$ (New equation)

Here, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

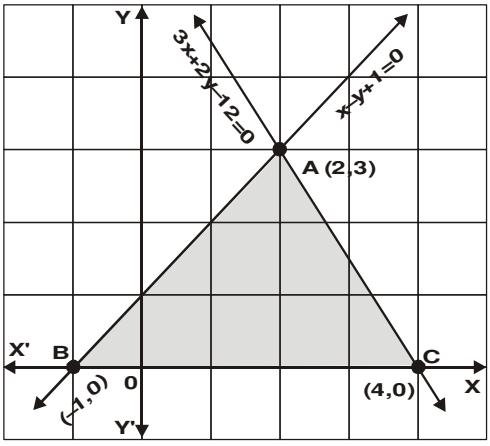
Hence, the graph of the two equations will be two intersecting lines. **(Rest Try Yourself)**

Ex.12 Draw the graphs of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. Determine the coordinates of the vertices of the triangle formed by these lines and the x-axis, and shade the triangular region.

Sol. $x - y + 1 = 0$ ...(i)

x	1	3
y = x + 1	2	4

$3x + 2y - 12 = 0$ ...(ii)



x	0	4
$y = \frac{12-3x}{2}$	6	0

The vertices of the triangle are
A (2, 3), B (–1, 0) and C (4, 0)

Ex.13 Solve the following pair of linear equations by the substitution method.

(i) $x + y = 14, x - y = 4$ (ii) $s - t = 3, \frac{s}{3} + \frac{t}{2} = 6$

(iii) $3x - y = 3, 9x - 3y = 9$ (iv) $0.2x + 0.3y = 1.3, 0.4x + 0.5y = 2.3$

(v) $\sqrt{2}x + \sqrt{3}y = 0, \sqrt{3}x - \sqrt{8}y = 0$ (vi) $\frac{3x}{2} - \frac{5y}{3} = -2, \frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

Sol. (i) $x + y = 14$ ...(i)

$x - y = 4$ ...(ii)

From (ii) $y = x - 4$ ...(iii)

Substituting y from (iii) in (i), we get

$x + x - 4 = 14 \Rightarrow 2x = 18 \Rightarrow x = 9$

Substituting x = 9 in (iii), we get

$y = 9 - 4 = 5,$

i.e, $y = 5$

$x = 9, y = 5$

(ii) $s - t = 3$ ...(i)

$\frac{s}{3} + \frac{t}{2} = 6$ ...(ii)

From (i) $s = t + 3$ ...(iii)

Substituting s from (iii) in (ii), we get

$\frac{t+3}{3} + \frac{t}{2} = 6 \Rightarrow 2(t + 3) + 3t = 36$

$\Rightarrow 5t + 6 = 36 \Rightarrow t = 6 \therefore s = 9, t = 6$ **(Rest Try Yourself)**

Ex.14 Solve the following pair of equations by the elimination method and the substitution method:

(i) $x + y = 5$ and $2x - 3y = 4$ (ii) $3x + 4y = 10$ and $2x - 2y = 2$

(iii) $3x - 5y - 4 = 0$ and $9x = 2y + 7$ (iv) $\frac{x}{2} + \frac{2y}{3} = -1$ and $x - \frac{y}{3} = 3$

Sol. (i) Solution By Elimination Method:

$x + y = 5$ ...(i)

$2x - 3y = 4$ ...(ii)

Multiplying (i) by 3 and (ii) by 1 and adding

we get $3(x + y) + 1 (2x - 3y)$

$= 3 \times 5 + 1 \times 4$

$\Rightarrow 3x + 3y + 2x - 3y = 19$

$\Rightarrow 5x = 19 \Rightarrow x = \frac{19}{5}$

From (i), substituting $x = \frac{19}{5}$, we get

$\frac{19}{5} + y = 5 \Rightarrow y = 5 - \frac{19}{5}$

$\Rightarrow y = \frac{6}{5}$

Solution By Substitution Method :

$x + y = 5$ ...(i)

$2x - 3y = 4$ ...(ii)

From (i), $y = 5 - x$ ...(iii)

Substituting y from (iii) in (ii),

$2x - 3(5 - x) \Rightarrow 2x - 15 + 3x = 4$

$\Rightarrow 5x = 19 \Rightarrow x = \frac{19}{5}$

Then from (iii), $y = 5 - \frac{19}{5} \Rightarrow y = \frac{6}{5}$

Hence, $x = \frac{19}{5}, y = \frac{6}{5}$

Hence, $x = \frac{19}{5}, y = \frac{6}{5}$ **(Rest Try Yourself)**

Ex.15 Which of the following pairs of linear equations has unique solution, no solution, or infinitely many solutions. In case there is a unique solution, find it by using cross multiplication method.

(i) $x - 3y - 3 = 0$ (ii) $2x + y = 5$ (iii) $3x - 5y = 20$

(iv) $x - 3y - 7 = 0$ $3x - 9y - 2 = 0$ $3x + 2y = 8$

$6x - 10y = 40$ $3x - 3y - 15 = 0$

Sol. (i) $x - 3y - 3 = 0, 3x - 9y - 2 = 0$

$\frac{a_1}{a_2} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{-3}{-9} = \frac{1}{3}, \frac{c_1}{c_2} = \frac{3}{2}$ $\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, no solution.

(ii) $2x + y = 5$ ...(i) and $3x + 2y = 8$ ...(ii)

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ $\left(\frac{a_1}{a_2} = \frac{2}{3}, \frac{b_1}{b_2} = \frac{1}{2}\right)$

Here, we have a unique solution. By cross multiplication, we have

$$\frac{x}{\begin{vmatrix} 1 & -5 \\ 2 & -8 \end{vmatrix}} = \frac{y}{\begin{vmatrix} -5 & 2 \\ -8 & 3 \end{vmatrix}} = \frac{1}{\begin{vmatrix} 2 & 1 \\ 3 & 2 \end{vmatrix}}$$

$$\Rightarrow \frac{x}{\{(1)(-8)-(2)(-5)\}} = \frac{y}{\{(-5)(3)-(-8)(2)\}} = \frac{1}{\{(2)(2)-(3)(1)\}}$$

$$\Rightarrow \frac{x}{(-8+10)} = \frac{y}{(-15+16)} = \frac{1}{(4-3)}$$

$\Rightarrow \frac{x}{2} = \frac{y}{2} = \frac{1}{1}$ $\Rightarrow \frac{x}{2} = \frac{1}{1}$ and $\frac{y}{1} = \frac{1}{1}$

$\Rightarrow x = 2$ and $y = 1$ **(Rest Try Yourself)**

Ex.16 (i) For which values of a and b does the following pair of linear equations have an infinite number of solutions?

$2x + 3y = 7, (a - b)x + (a + b)y = 3a + b - 2$

(ii) For which value of k will the following pair of linear equations have no solution?

$3x + y = 1, (2k - 1)x + (k - 1)y = 2k + 1.$

Sol. (i) $2x + 3y - 7 = 0$ ...(i)

$(a - b)x + (a + b)y - (3a + b - 2) = 0$ ...(ii)

For infinite number of solutions, we have

$$\frac{a-b}{2} = \frac{a+b}{3} = \frac{3a+b-2}{7}$$

For first and second, we have

$\frac{a-b}{2} = \frac{a+b}{3}$

or $3a - 3b = 2a + 2b$

or $a = 5b$ ...(i)

From second and third, we have

$\frac{a+b}{3} = \frac{3a+b-2}{7}$

or $7a + 7b = 9a + 3b - 6$

or $4b = 2a - 6$ or $2b = a - 3$ ...(ii)

From (i) and (ii), eliminating a,

$2b = 5b - 3 \Rightarrow b = 1$

Substituting $b = 1$ in (i), we get $a = 5$ **(Rest Try Yourself)**

Ex.17 Solve the following pairs of equations by reducing them to a pair of linear equations :

(i) $\frac{1}{2x}+\frac{1}{3y}=2$, $\frac{1}{3x}+\frac{1}{2y}=\frac{13}{6}$ (ii) $\frac{2}{\sqrt{x}}+\frac{3}{\sqrt{y}}=2$, $\frac{4}{\sqrt{x}}-\frac{9}{\sqrt{y}}=-1$

(iii) $\frac{4}{x}+3y=14, \frac{3}{x}-4y=23$ (iv) $\frac{5}{(x-1)}+\frac{1}{(y-2)}=2$, $\frac{6}{(x-1)}-\frac{3}{(y-2)}=1$

(v) $\frac{7x-2y}{xy}=5, \frac{8x+7y}{xy}=15$ (vi) $6x + 3y = 6xy, 2x + 4y = 5xy$

(vii) $\frac{10}{(x+y)}+\frac{2}{(x-y)}=4, \frac{15}{(x+y)}-\frac{5}{(x-y)}=-2$

(viii) $\frac{1}{(3x+y)}+\frac{1}{(3x-y)}=\frac{3}{4}, \frac{1}{2(3x+y)}-\frac{1}{2(3x-y)}=\frac{-1}{8}$

Sol. (i) $\frac{1}{2x}+\frac{1}{3y}=2$, $\frac{1}{3x}+\frac{1}{2y}=\frac{13}{6}$

Putting $\frac{1}{x}=u$ and $\frac{1}{y}=v$

We get $\frac{1}{2}u+\frac{1}{3}v=2, \frac{1}{3}u+\frac{1}{2}v=\frac{13}{6}$

Multiplying by 6 on both sides, we get

$\Rightarrow$ $3u + 2v = 12$ ...(i)

$2u + 3v = 13$ ...(ii)

Multiplying (i) by 3 and (ii) by 2, then subtracting later from first, we get

$3 (3u + 2v) - 2(2u + 3v) = 3 \times 12 - 2 \times 13$

$\Rightarrow$ $9u - 4u = 36 - 26$ $\Rightarrow u = 2$

Then substituting u = 2 in (i), we get

$6 + 2v = 12$ $\Rightarrow v = 3$

Now,u = 2 and v = 3

$\Rightarrow$ $\frac{1}{x} = 2$ and $\frac{1}{y} = 3$ $\Rightarrow x = \frac{1}{2}$ and $y = \frac{1}{3}$

(ii) [Hint : Put $\frac{1}{\sqrt{x}}=u \& \frac{1}{\sqrt{y}}=v$],

(iii) Try Yourself

(iv) [Hint : Put $\frac{1}{x-1} = u$ and $\frac{1}{y-2} = v$ to get :

$5u + v = 2$ and $6u - 3v = 1$]

(v) [Hint : $\frac{7x-2y}{xy}=5, \frac{8x+7y}{xy}=15$

$\Rightarrow \quad \frac{7x}{xy}-\frac{2y}{xy}=5, \frac{8x}{xy}+\frac{7y}{xy}=15$

$\Rightarrow \quad \frac{7}{y}-\frac{2}{x}=5, \frac{8}{y}+\frac{7}{x}=15$

Putting $\frac{1}{x} = u$ and $\frac{1}{y} = v$, we get

$7v - 2u = 5, 8v + 7u = 15$

(vi) [Hint : Divide both equation by xy

$\frac{6x+3y}{xy} = 6; \frac{2x+4y}{xy} = 5$

Now, same as (v)]

(vii) [Hint : Put $\frac{1}{x+y} = u$ and $\frac{1}{x-y} = v$ to get :

$10 u + 2v = 4$ and $15u - 5v = -2$]

(viii) [Hint : Put $\frac{1}{3x+y} = u$ and $\frac{1}{3x-y} = v$ to get :

$u + v = \frac{3}{4}$ and $\frac{1}{2}u - \frac{1}{2}v = -\frac{1}{8}$]

Ex.18 A fraction is such that if the numerator is multiplied by 3 and the denominator is reduced by 3, we get 18/11, but if the numbertor is increased by 8 and the denominator is doubled, we get 2/5. Find the fraction.

Sol. Let the fraction be $\frac{x}{y}$

Then, according to the given conditiosn, we have : $\frac{3x}{y-3}=\frac{18}{11}$ and $\frac{x+8}{2y}=\frac{2}{5}$

or $11x = 6y - 18$ and $5x + 40 = 4y$ or $11x - 6y = -18$ .... (i)

or $5x - 4y = -40$ ..... (ii)

Multiplying equation (i) by 2 and (ii) by 3, we get : $22x - 12y = -36$ ..... (iii),

$15x - 12y = -120$ ..... (iv)

Subtracting (iv) from (iii), we get : $7x = 84 \Rightarrow x = 12$ Substituting x = 12 in (i), we get : $11(12) - 6y = -18$

$\Rightarrow$ $132 - 6y = -18$ $\Rightarrow$ $-6y = -150$ $\Rightarrow$ $y = 25$ Hence the fraciton is $\frac{12}{25}$.

Ex.19 The sum of a two-digit number and the number obtained by reversing the order of its digits is 121, and two-digits differ by 3. Find the number.

Sol. Let the number be 10y + x.

Unit's digit = x, ten's digit = y. The number obtained by reversing the order of the digits is 10x + y.

According to the given conditions, we have : $(10y + x) + (10x + y) = 121 \Rightarrow 11(x+y) = 121 \Rightarrow x + y = 11$ ...(i)

and, $x - y = \pm 3$ [$\therefore$ Difference of digits is 3]

Thus, we have the following collection of simultaneous equations :

$\left.\begin{matrix} x+y=11 \\ x-y=3 \end{matrix}\right]$ ...(i) ...(ii) and or $\left.\begin{matrix} x+y=11 \\ x-y=-3 \end{matrix}\right]$ ...(iii) ...(iv)

On solving (i) and (ii), we get : x = 7, y = 4 On solving (iii) and (iv), we get : x = 4, y = 7

When x = 7, y = 4 We have : Number = 10y + x = 10 × 4 + 7 = 47

When x = 4, y = 7 We have : Number = 10y + x = 10 × 7 + 4 = 74

Hence, the number is either 47 or 74.

Ex.20 A and B are friends and their ages differ by 2 years. A's father D is twice as old as A and B is twice as old as his sister C. The ages of D and C differ by40 years. Find the ages of A and B.

Sol. Let the ages of A and B be x years and y years respectively. Then,
Also, according to the quesiton : $x - y = \pm 2$ [given]

D's age =2x years and C's age = $\frac{y}{2}$ years.

Clearly, D is older than C. $\therefore \quad 2x - \frac{y}{2} = 40 \Rightarrow 4x - y = 80$

Thus, we have the following two systems of linear equations :

$$\left.\begin{matrix} x - y = 2 \\ 4x - y = 80 \end{matrix}\right] \quad \begin{matrix} ...(i) \\ ...(ii) \end{matrix} \quad \text{and} \quad \left.\begin{matrix} x - y = -2 \\ 4x - y = 80 \end{matrix}\right] \quad \begin{matrix} ...(iii) \\ ...(iv) \end{matrix}$$

Substracting (i) from (ii), we get : $3x = 78 \Rightarrow x = 26$

Putting$x = 26$ in (i), we get : $y = 24$ and Substracting (iv) from (iii), we get $-3x = -82 \Rightarrow x = \frac{82}{3} = 27\frac{1}{3}$ and $y = 29\frac{1}{3}$.

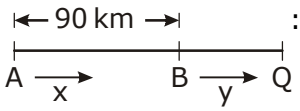
$\therefore$ Age of A is 26 years and B is 24 years.

Ex.21 Points A and B are 90 km apart from each other on a highway. A car starts from A and another from B at the same time. If they go in the same direction they meet in 9 hours and if they go in opposite direction they meet in $\frac{9}{7}$. Find their speeds.

Sol. Let X and Y be two cars starting from points A and B respectively
Let the speed of car X be x km/hr and that of car Y be y km/hr

Case 1 :

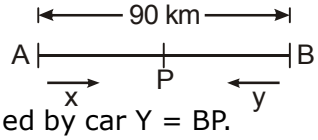
When two cars move in the same directions :



Then, distance travelled by car X = AQ,
and, distance travelled by car Y = BQ.
It is given that the two cars meet in 9 hours.
$\therefore$ Distance travelled by car X in 9 hours = 9x km [Distance = speed × time]
$\Rightarrow$ AQ = 9x
Distance travelled by car Y in 9 hours = 9y km [For Y, speed = y km/hr, time = 9 hours] $\Rightarrow$ BQ = 9y
Clearly, AQ – BQ = AB $\Rightarrow$ 9x – 9y = 90 [AB = 90 km] $\Rightarrow$ x – y = 10 .....(i)

Case II :

When two cars move in opposite directions :



Suppose two cars meet at point P.
Then, distance travelled by X = AP, and, distance travelled by car Y = BP.
In this case, two cars meet in $\frac{9}{7}$ hours. $\therefore$ Distance travelled by car X in $\frac{9}{7}$ hours = $\frac{9}{7}$x km $\Rightarrow$ AP = $\frac{9}{7}$x
Distance travelled by car Y in $\frac{9}{7}$ hours = $\frac{9}{7}$y km $\Rightarrow$ BP = $\frac{9}{7}$y
Clearly, AP + BP = AB $\Rightarrow \frac{9}{7}x + \frac{9}{7}y = 90 \Rightarrow \frac{9}{7}(x + y) = 90 \Rightarrow x + y = 70$ .....(ii)
Solving (i) and (ii), we get : $x = 40$ and $y = 30$.
Hence, speed of car X is 40 km/hr and speed of car Y is 30 km/hr.

Ex.22 The ratio of incomes of two persons is 9 : 7 and the ratio of their expenditures is 4 : 3. If each of them saves Rs 200 per month, find their monthly incomes.

Sol. Let the income of first person be Rs 9x and the income of second person be Rs 7x. Further; let the expenditures of first and second person be 4y and 3y respectively. Then,
Saving of first person = 9x – 4y, and Saving of second person = 7x – 3y
According to the questions :
9x – 4y = 200 .....(i) and 7x – 3y = 200 .....(ii)
Multiplying (i) by 3 and (ii) by 4, we get : 27x – 12y = 600 .....(iii) 28x – 12y = 800 .....(iv)
Subtracting (iii) from (iv), we get : $x = 200$
Substituting $x = 200$ in (i), we get : $9(200) - 4y = 200 \Rightarrow -4y = 200 - 1800 \Rightarrow -4y = -1600 \Rightarrow y = 400$
Thus, monthly income of first person = Rs. 9x = Rs 9 × 200 = Rs 1800
and monthly income of second person = Rs 7x = Rs(7 × 200) = Rs 1400.

EXERCISE – I UNSOLVED PROBLEMS

Q.1 On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the following points of linear equations are consistent or inconsistent.

(i) $3x + 2y = 5, 2x - 3y = 7$

(ii) $2x - 3y = 8, 4x - 6y = 9$

Q.2 For what value of k, the system of equations $x + 2y = 5, 3x + ky + 15 = 0$ has

(i) a unique solution (ii) No solution?

Q.3 Find the value of k for which the system of equations $4x + 5y = 0, kx + 10y = 0$ has infinitely many solutions.

Q.4 Find the value of a and b for which the given system of equations has an infinite number of solutions :

$2x + 3y = 7$; $(a + b + 1)x + (a + 2b + 2)y = 4(a + b) + 1$

Q.5 Which of the following pairs of linear equations are consistent/inconsistent? If consistent, obtain the solution graphically.

(i) $x + 2y - 3 = 0, 4x + 3y = 2$

(ii) $3x + y = 1, 2y = 2 - 6x$

(iii) $2x - y = 2, 2y - 4x = 2$

Q.6 Solve for x and y :

$4x + 3y = 24, 3y - 2x = 6$.

Q.7 Solve the following pair of linear equations by the substitution method.

$\sqrt{2}x + \sqrt{3}y = 0$ and $\sqrt{3}x - \sqrt{8}y = 0$

Q.8 Solve the following pair of linear equations by elimination method : $3x + 4y = 10$ and $2x - 2y = 2$.

Q.9 Solve : $ax + by = c, bx + ay = 1 + c$

Q.10 Solve by cross-multiplicaiton method :

$x + 2y + 1 = 0$ and $2x - 3y - 12 = 0$

Q.11 Solve by cross-multiplication method :

$(a - b)x + (a + b)y = 2(a^2 - b^2)$, $(a + b)x - (a - b)y = 4ab$.

Q.12 Solve for x and y :

$47x + 31y = 63, \ 31x + 47y = 15$.

Q.13 Solve for x and y : $\frac{3a}{x} - \frac{2b}{y} + 5 = 0$ and

$\frac{a}{x} + \frac{3b}{y} - 2 = 0$ $(x \neq 0, y \neq 0)$

Q.14 Solve $\frac{57}{x+y} + \frac{6}{x-y} = 5$ and $\frac{38}{x+y} + \frac{21}{x-y} = 9$.

Q.15 Solve for x and y :

$\frac{7x-2y}{xy} = 5, \frac{8x+7y}{xy} = 15$.

Q.16 7 audio cassettes and 3 video cassettes cost Rs.1110, while 5 audio cassettes and 4 video cassettes cost Rs. 1350. Find the cost of an audio cassette and a video cassette.

Q.17 The sum of the digits of a two-digit number is 12. The number obtained by interchanging its digits exceeds the given number by 18. Find the number.

Q.18 If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

Q.19 Two years ago, a father was five times as old as his son. Two years later, his age will be 8 more than three times the age of the son. Find the present ages of father and son.

Q.20 The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.

Q.21 A man travels 370 km partly by train and partly by car. If he covers 250 km by train and the rest by car it takes him 4 hours. But, if he travels 130 km by train and the rest by car, he takes 18 minutes, longer. Find the speed of the train and that of the car.

Q.22 8 men and 12 boys can finish a piece of work in 10 days while 6 men and 8 boys can finish it in 14 days. Find the time taken by one men alone and that by one boy alone to finish the work.

Q.23 State whether the system of linear equations $2x - 3y + 5 = 0$ and $4x - 6y + 10 = 0$ is consistent, inconsistent or dependent.

Q.24 "Three years ago father was four times the age of his son." If x and y represent the present ages of father and son in years respectively. Find the relation between x and y.

Q.25 Find the value of k, so that the following system of equations has no solution.

$3x - y - 5 = 0$; $6x - 2y - k = 0$

Q.26 Is $x = 2, y = 3$ a solution of the linear equation $2x + 3y - 13 = 0$.

Q.27 Express y in terms of x, for the equation $-3x + 5y - 11 = 0$. Find the point where the line represented by the given equation cuts the y-axis.

Q.28 Express x in terms of y, for the equation $4x - y + 7 = 0$. Find the point where the line $4x - y + 7 = 0$ cuts x–axis.

Q.29 Draw the graph of the equation $y = 4x$. Find whether $x = 0$, $y = 3$ is a solution of the equation.

Q.30 Show that $x = 2$, $y = 3$ is a solution of the linear pair, $x + 3y = 11$ and $5x - 2y - 4 = 0$.

Q.31 Solve the following linear pair by equating the coefficients :

$$\frac{x}{10} + \frac{y}{5} + 1 = 15;\ \frac{x}{8} + \frac{y}{6} = 15$$

Q.32 Solve for x and y : $0.04x + 0.02y = 5$; $0.5(x - 2) - 0.4y = 29$.

Q.33 If $2x + y = 35$ and $3x + 4y = 65$, find the value of $\frac{x}{y}$.

Q.34 Solve the linear pair : $3x - \frac{8}{y} = 5$, $x + \frac{6}{y} = 6$, $y \neq 0$

Q.35 Find algebraically whether the following pair of equations has infintely many solutions:
$3x - 5y = 20$, $6x - 10y = 40$.

Q.36 Find algebraically whehter the pair of equations $x - 2y = 0$, $5x - 10y = 10$ is consistent or inconsistent.

Q.37 Find whether the pair of equations $-3x + 4y = 5$, $\frac{9}{2}x - 6y + \frac{15}{2} = 0$ has a unique solution, no solution or infinite solutions.

Q.38 Find the value of k, for which the following pair of equations has no solution :
$kx - 5y = 2$, $6x + 2y = 7$.

Q.39 Obtain the condition that the pair of linear equations $ax + by = c$, $lx + my = n$ has a unique solution.

Q.40 Find the value of k, for which the pair of equations $3x + 5y = 0$, $kx + 10y = 0$, has a non-zero solution.

Q.41 For what value of k, the following pair of linear equations has infinite number of solutons :
$2x + 3y = 2$, $(k + 2)x + (2k + 1)y = 2(k - 1)$

Q.42 Find the value of k, so that the pair of linear equations will have infinite number of solutions :
$x + (2k - 1)y = 4$, $kx + 6y = k + 6$

Q.43 10 students of class X took part in Mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls who took part in the quiz.

Q.44 The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.

Q.45 Yash scored 40 marks in a test, getting 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks have been deducted for each incorrect answer, then Yash would have scored 50 marks. How many question were there in the test ?

Q.46 Solve for x and y, $152x - 378y = -74$; $-378x + 152y = -604$.

Q.47 Solve for x and y : $\frac{b}{a}x + \frac{a}{b}y = a^2 + b^2$ and $x + y = 2ab$

Q.48 Solve the following system of linear equations :
$ax + by = a - b$, $bx - ay = a + b$.

Q.49 Solve for x and y : $47x + 31y = 63$, $31x + 47y = 15$

Q.50 Solve for x and y : $\frac{ax}{b} - \frac{by}{a} = a + b$; $ax - by = 2ab$

Q.51 Half the perimeter of a rectangular garden, whose length is 4m more than its width, is 36m. Find the dimensions of the garden

Q.52 A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and the denominator.
If, 3 is added to both the numerator and the denominator it becomes $\frac{5}{6}$. Find the fraction.

Q.53 Ritu can row downstream 20 km. in 2 hours and upstream 4 km. in 2 hours. Find her speed of rowing in still water and the speed of the current.

Q.54 Solve the system of equations for x and y :

$$\frac{b^2x}{a} - \frac{a^2y}{b} = ab(a + b) \text{ and } b^2x - a^2y = 2a^2b^2$$

Q.55 Draw the graph of the equation $2x + y = 7$. From the graph, find
(i) whether point (3, 4) lies on the graph
(ii) is $x = 3$, $y = 1$ a solution of the equation
(iii) the value of x, when $y = 1$
(iv) the point where equation meet y-axis.

Q.56 The path of train A is given by $3x - 4y = 1$ and the path of another train B is given by the equation $8y - 6x = 4$. Represent this situation graphically.

Q.57 Show graphically, the linear pair $2x + 4y = 10$; $3x + 6y = 12$ has no solution.

Q.58 Solve the pair of equations $3x + y = 2$; $6x + 2y = 4$, graphically.

Q.59 Determine graphically, whether the linear pair $x - 2y = 2$; $4x - 2y = 5$ is consistent or inconsistent.

Q.60 Solve for x and y, the pair of equations :

$$\frac{2}{x}+\frac{2}{3y}=\frac{1}{6};\ \frac{3}{x}+\frac{2}{y}=0.$$

Hence, find the value of a for which $y = ax - 4$.

Q.61 Solve the pair of equations : $3(a + 3b) = 11ab$, $3(2a + b) = 7ab$

Q.62 Solve the pair of equations : $x + y = 5xy$, $3x + 2y = 13xy$; $x \neq 0$, $y \neq 0$

Q.63 Solve the following pair equations :

$$\frac{1}{2(x+2y)}+\frac{5}{3(3x-2y)}=-\frac{3}{2},\ \frac{5}{4(x+2y)}-\frac{3}{5(3x-2y)}=\frac{61}{60}$$

Q.64 Solve for x and y : $\frac{xy}{x+y}=\frac{6}{5},\ \frac{xy}{y-x}=6,$

where $x + y \neq 0$, $y - x \neq 0$

Q.65 Solve for x and y, using method of cross multiplication, $x + y = a + b$, $ax - by = a^2 - b^2$.

Q.66 Solve the following pair of equations for x and y : $ax + 2by = 3ab$, $3ax + by = 4ab$.

Q.67 Solve the following pair of equations by corss multiplication method : $\frac{x}{a}+\frac{y}{b}=a+b,\ \frac{x}{a^2}+\frac{y}{b^2}=2$

Q.68 Solve for x and y : $(a - b)x + (a + b)y = a^2 - 2ab - b^2$, $(a + b)(x + y) = a^2 + b^2$.

Q.69 A fraction becomes $\frac{4}{5}$ if 1 is added to both the numerator and the denominator. However, if 5 is subtracted from both the numerator and the denominator the fraction becomes $\frac{1}{2}$. Find the fraction.

Q.70 Five years hence the age of Jacob will be three times his son's age and five years ago, Jacob's age was seven times as old as his son. Find their present ages.

Q.71 Four times B's age exceeds A's age by 20 years, and one-third of A's age is less than B's age by two years. Find their ages.

Q.72 The age of a man is three times the sum of the ages of his two children and five years hence, his age will be double the sum of their ages. Find his present age.

Q.73 90% and 97% pure acid solutions are mixed to obtain 21 litres of 95% pure solution. How many litres of each solution are needed?

Q.74 A man has Rs. 50 in 50p. and 25p. coins. All the 50 p. coins are worth as much as all the 25 p. coins. How many coins of each he has?

Q.75 A person sells two articles together for Rs. 46, making a profit of 10% on one and 20% on the other. If he had sold each article at 15% profit, the result would have been the same. At what price did he buy each article?

Q.76 One alloy of iron is 49% iron and another 28% iron. How many tonne of each should be used to make 120 tonne of 42% iron alloy ?

Q.77 In a ΔABC, $\angle C = 3\angle A$ and $\angle B = 2(\angle A + \angle C)$. Find the angles.

Q.78 In a cyclic quadrilateral ABCD,

$\angle A = (2x + 4)^o$, $\angle B = (y + 3)^o$, $\angle C = (2y + 10)^o$ and $\angle D = (4x - 5)^o$, find the four angles.

Q.79 Solve the following system of linear equations graphically :

$4x - 5y - 20 - = 0$, $3x + 5y - 15 = 0$

Determine the vertices of the triangle formed by the lines, representing the above equations, and the y-axis.

Q.80 The population of a town is 50,000. If in a year the number of males were to increase by 5% and that of females by 3% annually, the population would grow to 52,020. Find the number of males and females in the town at present.

Q.81 Gloria is walking along the path joining (–2, 3) and (2, –2) while Suresh is walking along the path joining (0, 5) and (4, 0). Represent the situation graphically.

Q.82 The taxi charges in a city consists of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is Rs. 105 and for a journey of 15 km, the charge paid is Rs. 155. What are the fixed charges and the charge per kilometer? How much does a person have to pay for travelling a distance of 25 km ?

Q.83 Draw the graphs of the equation $5x - y = 5$ and $3x - y = 3$. Determine the coordinates of the vertices of the traingle formed by these lines and the y-axis.

Q.84 Two years ago, a father was five times as old as his son. Two years later, his age will be 8 more than three times the age of the son. Find the present ages of father and son.

ANSWER KEY

1. (i) Consistent (ii) inconsistent

2. (i) $k \neq 6$, (ii) $k = 6$ **3.** $k = 8$

4. $a = 3, b = 2$

5. (i) consistent $x = -1, y = 2$

(ii) dependent (infinite)

(iii) inconsistent (no solution)

6. $x = 3, y = 4$ **7.** $x = 0, y = 0$

8. $x = 2, y = 1$

9. $x = \frac{ac-bc-b}{a^2-b^2}$, $y = \frac{ac-bc+a}{a^2-b^2}$

10. $x = 3, y = -2$ **11.** $x = a + b, y = a - b$

12. $x = 2 ; y = -1$ **13.** $x = -a ; y = b$

14. $x = 11, y = 8$ **15.** $x = 1, y = 1$

16. audio cassette = Rs. 30, video cassette = Rs. 300

17. 57 **18.** 3/5

19. Father's age = 42yrs, Son's = 10 yrs

20. 99°, 81°

21. Train = 100 km/h, Car = 80 km/h

22. Man = 140 days, Boy = 280 days

23. Consistent **24.** $x - 4y + 9 = 0$

25. $k \neq 10$ **26.** yes

27. $y = \frac{3x+11}{5}$, (0, 11/5)

28. $x = \frac{y-7}{4}$, (–7/4, 0) **29.** no

31. 80, 30 **32.** 100, 50 **33.** $x = 15, y = 5, 3$

34. 3, 2 **35.** yes **36.** Inconsistent

37. Infinite **38.** –15 **39.** $am \neq b\ell$

40. 6 **41.** 4 **42.** 2

43. 3, 7 **44.** 99°, 81°

45. 20

46. 2, 1 **47.** ab, ab **48.** 1, –1

49. 2, –1 **50.** b, –a **51.** 20m, 16m

52. 7/9 **53.** 6, 4 **54.** a^2, $-b^2$

55. (i) not **(ii)** yes **(iii)** 3 **(iv)** (0,7)

58. infinite **59.** consistent

60. $x = 6, y = -4, a = 0$ **61.** 1, 3/2

62. 1/2, 1/3 **63.** 1/2, 5/4

64. 2, 3 **65.** a, b **66.** b, a

67. a^2, b^2 **68.** a + b, $\frac{-2ab}{a+b}$

69. 7/9 **70.** 40, 10 **71.** 36, 14

72. 45 **73.** 6,15 **74.** 50, 100

75. 20, 20 **76.** 80, 40 **77.** 15, 120, 45

78. 70, 53, 110, 127 **79.** (5,0) (0,3), (0,–4)

80. 26000, 24000

81. Gloria & Suresh walk parallel to each other

82. Fixed charge = Rs. 5, charge per km. = Rs.10, ∴ Rs. 255

83. (1, 0), (0, –3), (0, – 5)

84. Father's age = 42yrs, Son's = 10 yrs

EXERCISE – II BOARD PROBLEMS

Q.1 Find the value of k for which the following system of linear equations has infinite number of solutions $x + (k + 1)y = 5$; $(k + 1)x + 9y = 8k - 1$

Q.2 Find the value of k so that the system of linear equations will have infinite number of solutions :
$x + (k + 2)y = 4$; $(2k - 1)x + 25y = 6k + 2$

Q.3 Solve the following system of linear equations : $2(ax - by) + (a + 4b) = 0$, $2(bx + ay) + (b - 4a) = 0$.

OR

Two years ago, a father was five times as old as his son. Two years later, his age will be 8 more than three times the age of the son. Find the present ages of father and son.

Q.4 Solve the following system of linear equations : $6(ax + by) = 3a + 2b$; $6(bx - ay) = 3b - 2a$.

OR

The sum of the digits of a two digit number is 15. The number obtained by interchanging the digits exceeds the given number by 9. Find the number

Q.5 Solve the following system of linear equations : $3(bx + ay) = a - 6b$, $3(ax - by) = -(6a + b)$.

OR

If 1 is added to each of numerator and denominator of a fraction, it becomes 2/3. However, if 1 is subtracted from each of numerator and denominator it becomes 3/5. Find the fraction.

Q.6 Solve for x and y : $\frac{4}{x} + 3y = 14, \frac{3}{x} - 4y = 23$

OR

Solve for x and y : $\frac{b}{a}x + \frac{a}{b}y = a^2 + b^2$, $x + y = 2ab$.

Q.7 If $(x - 4)$ is a factor of $x^3 + ax^2 + 2bx - 24$ and $a - b = 8$, find the values of a and b.

Q.8 If $(x + 3)$ is a factor of $x^3 + ax^2 - bx + 6$ and $a + b = 7$, find the values of a and b

Q.9 If $(x + 2)$ is a factor of $x^3 + ax^2 + 4bx + 12$ and $a + b = -4$, find the values of a and b.

Q.10 Solve for x and y :

$\frac{2}{x} + \frac{3}{y} = 13, \frac{5}{x} - \frac{4}{y} = -2,\ x, y \neq 0$

OR

Solve for x and y : $ax + by - a + b = 0$, $bx - ay - a - b = 0$

Q.11 If $(x - 2)$ is a factor of $x^3 + ax^2 + bx + 18$ and $a - b = 7$, find a and b.

Q.12 Solve the following system of linear equations: $ax + by = a - b$, $bx - ay = a + b$.

Q.13 Solve for x and y : $\frac{x}{a} + \frac{y}{b} = 2$, $ax - by = a^2 - b^2$

OR

A two digit number is four times the sum of its digits and twice the product of the digits. Find the number.

Q.14 Solve for x and y : $\frac{x}{a} - \frac{y}{b} = a - b$, $ax + by = a^3 + b^3$.

OR

A number consisting of two digits, is equal to 7 times the sum of its digits. When 27 is subtracted from the number, the digits interchange places. Find the number.

Q.15 Solve for x and y : $\frac{2a}{x} + \frac{3b}{y} + 1 = 0; \frac{3a}{x} - \frac{b}{y} - 4 = 0$

Q.16 Solve for x and y : $\frac{3a}{x} - \frac{2b}{y} + 5 = 0; \frac{a}{x} + \frac{3b}{y} - 2 = 0$

Q.17 Solve for x and y : $47x + 31y = 63$, $31x + 47y = 15$

OR

Solve for x and y : $\frac{ax}{b} - \frac{by}{a} = a + b; ax - by = 2ab$

Q.18 Solve the system of equations :

$\frac{bx}{a} - \frac{ay}{b} + a + b = 0$ and $bx - ay + 2ab = 0$

OR

The sum of the digits of a two digit number is 12. The number obtained by interchanging the two digits exceeds the given number by 18. Find the number

Q.19 Solve the system of equations for x :

$\frac{b^2x}{a} - \frac{a^2y}{b} = ab(a + b)$ and $b^2x - a^2y = 2a^2b^2$

OR

A man sold a table and a chair together for Rs. 850 at a loss of 10% on the table and a gain of 10% on the chair. By selling them together for Rs. 950, he would have made a gain of 10% on the table and loss of 10% on the chair. Find the cost price of each.

Q.20 Solve the following equations for x and y : $mx - ny = m^2 + n^2$, $x + y = 2m$

OR

Abdul travelled 300 km by train and 200 km by taxi, it took him 5 hours 30 minutes. But if he travels 260 km by train and 240 km by taxi he takes 6 minutes longer. Find the speed of the train and that of the taxi

Q.21 Solve the following equations for x and y :

$$\frac{a^2}{x} - \frac{b^2}{y} = 0 ; \frac{a^2 b}{x} + \frac{b^2 a}{y} = a + b \, x, y \neq 0.$$

OR

The sum of the numerator and the denominator of a fraction is 12. If the denominator is increased by 3, the fraction becomes $\frac{1}{2}$. Find the fraction.

Q.22 Solve for x and y : $x + \frac{6}{y} = 6, \; 3x - \frac{8}{y} = 5$

OR

Solve for x and y :

$$\frac{x+1}{2} + \frac{y-1}{3} = 8 ; \frac{x-1}{3} + \frac{y+1}{2} = 9$$

Q.23 Solve for x and y : $8x - 9y = 6xy$; $10x + 6y = 19xy$

OR

Solve for x and y : $4x + \frac{y}{3} = \frac{8}{3} ; \frac{x}{2} + \frac{3y}{4} = -\frac{5}{2}$

Q.24 Find the value of k so that the following system of equations has no solution :

$3x - y = 5$; $6x - 2y - k = 0$

Q.25 Find the value of k so that the following system of equations has infinite solutions:

$3x - y - 5 = 0$; $6x - 2y + k = 0$

Q.26 Find the value(s) of k for which the pair of linear equations $kx + 3y = k - 2$ and $12x + ky = k$ has no solution

Q.27 Find the number of solutions of the following pair of linear equations :

$x + 2y - 8 = 0$; $2x + 4y = 16$

Q.28 Write whether the following pair of linear equations is consistent or not :

$x + y = 14$; $x - y = 4$

Q.29 Without drawing the graph find out whether the lines representing the following pair of linear equations intersect at a point, are parallel or coincident : $9x - 10y = 21$; $\frac{3}{2}x - \frac{5}{3}y = \frac{7}{2}$

Q.30 Without drawing the graph find out whether the lines representing the following pair of linear equations intersect at a point, are parallel or coincident :

$18x - 7y = 24$; $\frac{9}{5}x - \frac{7}{10}y = \frac{9}{10}$

Q.31 Without drawing the graph, find out whether the lines representing the following pair of linear equations intersect at a point, are parallel or coincident : $5x + 3y - 6 = 0$; $\frac{9}{5}x + 3y = 6$

ANSWER KEY

1. k = 2 **2.** k = 3
3. x = – 1/2, y = 2 or 42yrs, 10yrs
4. x = 1/2, y = 1/3 or 78
5. x = –2, y = 1/3 or 7/11
6. x = 1/5, y = – 2 or x = ab, y = ab
7. a = 1, b = – 7
8. a = 0, b = 7
9. a = – 3, b = – 1
10. x = 1/2, y = 1/3 or x = 1, y = – 1
11. a = – 2, b = – 9
12. x = 1, y = – 1
13. x = a, y = b or 36
14. $x = a^2$, $y = b^2$ or 63
15. x = a, y = – b
16. x = – a, y = b
17. x = 2, y = – 1 or x = b, y = – a
18. x = – a, y = b or 57
19. $x = a^2$, $y = -b^2$ or cost of table = Rs. 700, cost of chair = Rs. 200
20. x = m + n, y = m – n or speed of train = 100 km h. Speed of taxi = 80 km/h
21. $x = a^2$, $y = b^2$ or $\frac{5}{7}$
22. $x = -\frac{14}{5}$, $y = \frac{10}{13}$ or x = 7, y = 13
23. x = 3/2, y = 2/3 or x = 1, y = – 4
24. $k \neq 10$ **25.** k = – 10 **26.** $k = \pm 6$
27. Infinite number of solutions **28.** Consistent
29. Coincident lines
30. Parallel **31.** Unique solution.

EXERCISE – III NTSE /OLYMPIAD /FOUNDATION PROBLEMS

Q.1 The line $x + 1 = 0$ is
(A) parallel to y-axis
(B) parallel to x-axis
(C) passing through the origin
(D) none of these

Q.2 The line $y - 2 = 0$ is
(A) parallel to x-axis
(B) parallel to y-axis
(C) passing through the origin
(D) none of these

Q.3 A pair of linear equations in two variables which has a common point i.e., which has only one solution is called is :
(A) consistent pair (B) inconsistent pair
(C) dependent pair (D) none of these

Q.4 A system of simultaneous linear equations is said to be inconsistent, if it has :
(A) one solution (B) two solutions
(C) three solutions (D) no solutions

Q.5 Which of the following system of equations is consistent ?
(A) $3x - y = 1, 6x - 2y = 5$
(B) $4x + 6y - 7 = 0, 12x + 18y - 21 = 0$
(C) $4x + 7y = 3, 8x + 14y = 7$
(D) none of these

Q.6 For what value of k, the system of equations $kx - y = 2, 6x - 2y = 3$ has infinitely many solutions ?
(A) $k = 3$ (B) $k \neq 4$
(C) $k = 6$ (D) does not exist

Q.7 In the equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, then the equation will represent :
(A) coincident lines
(B) parallel lines
(C) intersecting lines
(D) none of these

Q.8 If a pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ represent parallel lines, then :

(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) none of these

Q.9 If a pair of linear equation $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ represents coincident lines, then :

(A) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (B) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

(C) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (D) none of these

Q.10 For what value of k, the following system of equations $3x + 5y = 0$, $kx + 10y = 0$ has a non-zero solution?
(A) $k = 3$ (B) $k = 4$
(C) $k = -4$ (D) $k = 6$

Q.11 The solution of the system of equations $2x + 3y + 5 = 0$ and $3x - 2y - 12 = 0$ is
(A) $x = -3, y = 2$ (B) $x = 2, y = -3$
(C) $x = 3, y = -2$ (D) $x = -2, y = 3$

Q.12 The coordinates of the points where the lines $3x - y = 5, 6x - y = 10$ meet the y-axis
(A) $(0, -5), (0, -10)$ (B) $(-5, 0), (-10, 0)$
(C) $(-5, 0), (0, -10)$ (D) $(0, -5), (0, -10)$

Q.13 The coordinates of the point where the line $2(x - 3) = y - 8$ meet the x-axis
(A) (3, 0) (B) (2, 0)
(C) (–1, 0) (D) none

Q.14 Which of the following system of equations has no solution ?
(A) $3x - y = 2, 9x - 3y = 6$
(B) $4x - 7y + 28 = 0, 5y - 7x + 9 = 0$
(C) $3x - 5y - 11 = 0, 6x - 10y - 7 = 0$
(D) None

Q.15 Which of the following system of equations has unique solution ?
(A) $3x + y = 2, 6x + 2y = 3$
(B) $2x - 5y = 3, 6x - 15y = 9$
(C) $x - 2y = 3, 3x - 2y = 1$
(D) None

Q.16 Which of the following system of equations has infinitely many solutions ?
(A) $5x - 4y = 20, 7.5x - 6y = 30$
(B) $2x - 3y = 5, 3x - 4.5y = 7.5$
(C) $x + 5y - 3 = 0, 3x + 15y - 9 = 0$
(D) All the above

Q.17 The solution of the system of equations $2x - 3y + 4xy = 0$ and $6x + 5y - 2xy = 0$ is

(A) $x = 0, y = 0$ (B) $x = 1, y = -2$

(C) both (D) none

Q.18 The solution of the system of equations $\frac{2x+5y}{xy} = 6$ and $\frac{4x-5y}{xy} + 3 = 0$ (where $x \neq 0, y \neq 0$) is

(A) $x = 1, y = 2$ (B) $x = 0, y = 0$

(C) $x = -1, y = 2$ (D) $x = 1, y = -2$

Q.19 If A : Homogeneous system of linear equations is always consistent. R : $x = 0, y = 0$ is always a solution of the homogeneous system of equations with unknowns x and y, then which of the following statement is true ?

(A) A is true and R is the correct explanation of A

(B) A is false and R is not the correct explanation of A

(C) A is true and R is false

(D) A is false and R is true

Q.20 For what value of k, the system of equations $x + 2y = 3, 5x + ky + 7 = 0$ has unique solution?

(A) $k = 10$

(B) All real values except 10

(C) All natural numbers except 10

(D) Does not exist

Q.21 The solution of the system of equations by $\frac{x+y-8}{2} = \frac{x+2y-14}{3} = \frac{3x+y-12}{11}$ is

(A) $x = 2, y = 8$ (B) $x = 4, y = 4$

(C) $x = 2, y = 6$ (D) $x = 4, y = 6$

Q.22 For what value of p will the system of equations $3x + y = 1, (2p - 1)x + (p - 1)y = (2p + 1)$ has no solution ?

(A) $p = 2$ (B) $p \neq 2$

(C) $p = -2$ (D) $p \neq -2$

Q.23 The solution of the system of equations $\sqrt{2}x + \sqrt{5}y = 0$ and $\sqrt{3}x - \sqrt{7}y = 0$ is

(A) $x = \sqrt{3}, y = \sqrt{5}$ (B) $x = \sqrt{2}, y = \sqrt{7}$

(C) $x = 1, y = \sqrt{2}$ (D) $x = 0, y = 0$

Q.24 For what value of p does the system of equations $2x - py = 0, 3x + 4y = 0$ has nonzero solution ?

(A) $p = -6$ (B) $p = \frac{-8}{3}$

(C) $p = \frac{-2}{3}$ (D) None

Q.25 The sum of the digits of a two digit number is 8. If the digits are reversed, the number is decreased by 54. Find the number

(A) 62 (B) 80

(C) 71 (D) 53

Q.26 The LCM of two numbers is 630 and their HCF is 9. If the sum of the numbers is 153, their difference is

(A) 63 (B) 27

(C) 81 (D) 18

Q.27 The product of two numbers is 12960 and their HCF is 36. How many pairs of such numbers can be formed ?

(A) 2 (B) 3

(C) 4 (D) 5

Q.28 The system of equations $4x + 5y + 5 = 0$ and $2x + 3y + 7 = 0$ has :

(A) no solution

(B) exactly one solution

(C) infinitely many solutions

(D) none of these

Q.29 If $\frac{x}{b} = \frac{y}{a}$, $bx + ay = a^2 + b^2$, then the values of x and y are :

(A) a and b (B) a and –b

(C) b and –a (D) b and a

Q.30 For what value of k will the equations $x + 2y + 7 = 0$, $2x + ky + 14 = 0$ represent coincident lines ?

(A) 4 (B) –4

(C) $\frac{4}{3}$ (D) $\frac{3}{4}$

Q.31 Find the value of k for which the system of equations $2x - 3y = 7$ and $(k + 2)x - (2k + 1)y = 3(2k - 1)$ have infinitely many solutions.

(A) 2 (B) –2

(C) 3 (D) 4

Q.32 If $am \neq bl$, then the system of equations
$ax + by = c$, $lx + my = n$
(A) has a unique solution
(B) has no solution
(C) has infinitely many solutions
(D) may or may not have a solution

Q.33 For what value of k, will the following system of linear equations have no solutions ?
$3x + y = 1$, $(2k - 1)x + (k - 1)y = 2k + 2$
(A) $k = 1$ (B) $k = 2$
(C) $k = -1$ (D) $k = -2$

Q.34 Determine the values of a and b for which the following system of linear equations have infinite solutions :
$2x - (a - 4)y = 2b + 1$, $4x - (a - 1)y = 5b - 1$
(A) $a = 3, b = 7$ (B) $a = 7, b = 3$
(C) $a = 10, b = 7$ (D) $a = 4, b = 7$

Q.35 The sum of salaries of A and B are Rs. 2100. A spends 80% of his salary and B spends 70%. If their savings are now in the proportion of 4 : 3, what is the salary of A?
(A) Rs. 700 (B) Rs. 1000
(C) Rs. 1400 (D) Rs. 1200

Q.36 Divide 62 into two parts such that fourth part of the first and two-fifth part of the second are in the ratio 2 : 3.
(A) 24, 38 (B) 32, 30
(C) 16, 46 (D) 40, 22

Q.37 The income of P and Q are in the ratio 3 : 2 and expenses are in the ratio 5 : 3. If both save Rs. 200, what is the income of P ?
(A) Rs. 700 (B) Rs. 1000
(C) Rs. 1400 (D) Rs. 1200

Q.38 If the ratio of boys to girls in a class is B and the ratio of girls to boys is G, then
B + G is
(A) greater than 1 or equal to 1
(B) greater than 1
(C) less than 1
(D) equal to 1

Q.39 The ratio between a two-digit number and the sum of digits of that number is 4 : 1. If the digit in the unit place is 3 more than the digit in the tenth place, what is that number ?
(A) 63 (B) 36
(C) 24 (D) Insufficient data

Q.40 The ratio of two numbers is 3 : 8 and their difference is 115. The largest number is
(A) 115 (B) 69
(C) 184 (D) 240

Q.41 A toy train crosses 210 m and 122 m long tunnels in 25 and 17 seconds respectively. The length of the train is _____ .
(A) 11 m (B) 65 m
(C) 332 m (D) 88 m

Q.42 Two numbers are such that thier difference, their sum and their product are to one another as 1 : 7 : 24. The product of two numbers is _____.
(A) 12 (B) 24
(C) 48 (D) 96

Q.43 For the equations $5x - 6y = 2$ and $10x = 12y + 7$
(A) there is no solution
(B) there exists unique solution
(C) there are two solutions
(D) there are infinite number of solutions.

Q.44 The sum of two numbers is 20 and their product is 64. Then one of the number is
(A) 14 (B) 16
(C) 12 (D) 8

Q.45 When simple interest is charged, a certain principle amounts to Rs. 7400 in 4 years and Rs. 9200 in 7 years. Then the rate of interest is
(A) 6% (B) 8%
(C) 10% (D) 12%

Q.46 The denominator of a rational number is greater than its numerator by 3. If 3 is subtraced from the numerator and 2 is added to the denominator, the new number becomes $\frac{1}{5}$. Then the original number was
(A) $\frac{7}{11}$ (B) $\frac{3}{5}$
(C) $\frac{5}{8}$ (D) $\frac{4}{7}$

Q.47 3 men and 6 boys can finish a piece of work in 3 days, while 2 men and 5 boys can finissh it in 4 days. Then time taken by one boy alone to finish the work is
(A) 18 days (B) 36 days
(C) 24 days (D) None

Q.48 In ΔABC, if $\angle A = x^o$, $\angle B = 3x^o$, $\angle C = y^o$ and $3y - 5x = 30$, then ΔABC is _____ .

(A) a right angled triangle

(B) an isosceles triangle

(C) an equilateral

(D) a right angled isosceles triangle

Q.49 The age of woman is four times the age of her daughter. Five years hence, the age of the woman will be three times the age of her daughter. The present age of daughter is _____ .

(A) 40 years (B) 10 years

(C) 18 years (D) 20 years

Q.50 Of the following alternatives, the one that includes all values of x which satisfy $2x - 3 > 7 - x$ is :

(A) $x > 4$ (B) $x < \frac{10}{3}$

(C) $x = \frac{10}{3}$ (D) $x > \frac{10}{3}$

Q.51 The solution of $\sqrt{5x-1} + \sqrt{x-1} = 2$ is :

(A) $x = 5$ (B) $x = \frac{2}{3}$

(C) $x = 3$ (D) $x = 1$

Q.52 Given $b \neq a$, the fractions $\frac{ax+b}{cx+d}$ and $\frac{b}{d}$ are unequal if :

(A) $a = c = 1$ and $x \neq 0$

(B) $a = b = 0$

(C) $a = c = 0$

(D) $x = 0$

Q.53 If $8 \cdot 2^x = 5^o$, then $x =$ _____

(A) -3 (B) 3

(C) 2 (D) 4

Q.54 The solution of the system of equations

$\frac{1}{2x} - \frac{1}{y} = -1$, $\frac{1}{x} + \frac{1}{2y} = 8$ is :

(A) $\frac{1}{6}, \frac{1}{4}$ (B) $\frac{1}{4}, \frac{1}{6}$

(C) $\frac{1}{2}, \frac{1}{3}$ (D) $\frac{1}{3}, \frac{1}{2}$

Q.55 The solution of the system of equations

$ax + by - a + b = 0$, $bx - ay - a - b = 0$ is

(A) 1, -1 (B) 1, 1

(C) -1, -1 (D) -1, -2

Q.56 5 books and 7 pens together cost Rs 79, whereas 7 books and 5 pens together cost Rs 77. Find the total cost of 1 book and 2 pens.

(A) Rs 15 (B) Rs 20

(C) Rs 30 (D) Rs 40

Q.57 The unit's digit of a two digit number is twice its ten's digit. If the digits are reversed, the number is 27 more than the original number. The number is :

(A) 24 (B) 36

(C) 48 (D) none of these

Q.58 Two numbers are such that 7 times the first added to 4 times the second equals 37, while 3 times the first added to 9 times the second equals 45. The numbers are :

(A) 2 and 4 (B) 3 and 4

(C) 4 and 6 (D) none of these

Q.59 The value of k for which the system of equations $2x + 3y = 5$, $4x + ky = 10$ has inifinite number of solutions, is :

(A) $k = 1$ (B) $k = 3$

(C) $k = 6$ (D) $k = 0$

Q.60 The value of k for which the system of equations $x + 2y - 3 = 0$ and $5x + ky + 7 = 0$ has no solution, is :

(A) $k = 10$ (B) $k = 6$

(C) $k = 3$ (D) $k = 1$

Q.61 The value of k for which of the system of equations $x + 2y = 5$, $3x + ky + 15 = 0$ has no solution, is

(A) $k = 6$ (B) $k = -6$

(C) $k = \frac{3}{2}$ (D) none of these

Q.62 The value of k for which the system of equations $3x + 5y = 0$ and $kx + 10y = 0$ has a non-zero solution, is :

(A) $k = 0$ (B) $k = 2$

(C) $k = 6$ (D) $k = 8$

Q.63 The equation $\sqrt{x+4} - \sqrt{x-3} + 1 = 0$ has :

(A) no root

(B) one real root

(C) one real root and one imaginary root

(D) two imaginary roots

Q.64 When x^5, $x + \frac{1}{x}$, $1+\frac{2}{x}+\frac{3}{x^2}$ are multiplied, the product is a polynomial of degree

(A) 5 (B) 6

(C) 4 (D) 3

Q.65 The primes p, q and r satisfy p + q = r where "r" is an even and 1 < p < q, then p equals :

(A) 2 (B) 3

(C) 7 (D) 13

Q.66 If $x \neq 0$, $\frac{x}{2} = y^2$ and $\frac{x}{4} = 4y$, then "x" equal to :

(A) 8 (B) 16

(C) 128 (D) 64

Q.67 If x, y and $y - \frac{1}{x}$ are not zero, then $\frac{x-\frac{1}{y}}{y-\frac{1}{x}}$ equal to

(A) 1 (B) $\frac{x}{y}$

(C) $\frac{y}{x}$ (D) $\frac{x}{y}-\frac{y}{x}$

Q.68 If the system equations, 2x+3y = 7, 2ax + (a+b) y=28 has infinitely many solutions, then :

(A) a = 2b (B) b = 2a

(C) a + 2b = 0 (D) 2a + b = 0

Q.69 The age of a man in four times the age of his son. Five years hence, the age of the man will be three times the age of his son. The present age of son is :

(A) 15 years (B) 10 years

(C) 18 years (D) 20 years

Q.70 The solution of the system of equations

37x + 41y = 70, 41x + 37y = 86 is :

(A) x = −1, y = 1 (B) x = −2, y = 3

(C) x = 3, y = −1 (D) none of these

Q.71 The solution of the system of the equations, $\frac{x+y}{xy}=2, \frac{x-y}{xy}=6$ is :

(A) $x = -\frac{1}{2}, y = \frac{1}{4}$ (B) $x = \frac{3}{2}, y = \frac{1}{4}$

(C) $x = \frac{1}{2}, y = \frac{1}{3}$ (D) $x = -\frac{1}{2}, y = -\frac{1}{4}$

Q.72 If twice the son's age in years is added to the father's age, the sum is 70. But, if twice the father's age is added to the sum's age, the sum is 95. The ages of father and son are :

(A) 40, 15 (B) 45, 20

(C) 48, 18 (D) none of these

Q.73 The taxi charges in a city comprise of a fixed charge together with the charge for the distance covered. For a journey of 10 km, the charge paid is Rs 75 and for journey of 15 km, the charge paid is Rs 110. What will a person have to pay for travelling a distance of 25 km?

(A) Rs 150 (B) Rs 165

(C) Rs 172 (D) Rs 180

Q.74 Divide 62 into two parts such that one-fourth part of the first two-fifths part of the second are in the ratio 2 : 3.

(A) 24, 38 (B) 32, 30

(C) 16, 46 (D) 40, 22

Q.75 For what values of a and b the equations

2x + 3y = 7, (a − b)x + (a + b)y =

(3a + b − 2) represent coincident lines ?

(A) a = −5, b = 1 (B) a = 5, b = 1

(C) a = −5, b = −1 (D) a = 5, b = −1

Q.76 The income of P and Q are in the ratio 3 : 2 and expenses are in the ratio 5 : 3. If both save Rs 200, what is the income of P

(A) Rs 800 (B) Rs 1000

(C) Rs 1200 (D) Rs 1400

Q.77 'A' says to 'B' "My present age is five times your that age when I was as old as you are now." The sum of their present ages is 48 years. Their present ages are :

(A) 30 years, 18 years

(B) 25 years 16 years

(C) 32 years 20 years

(D) none of these

Q.78 The ratio between a two-digit number and the sum of digits of that number is 4 : 1. If the digit in the units place is 3 more than the digit in the tens place, then the number is :

(A) 63 (B) 36

(C) 24 (D) 26

Q.79 A man has only 20 paise and 25 paise coins in a bag. If he has 50 coins in all totalling to Rs 11.25, then number of coins of 20 paise are :

(A) 28 (B) 27

(C) 25 (D) 27

Q.80 In the above question, the number of coins of 25 paise are :

(A) 28 (B) 27

(C) 26 (D) 25

Q.81 The sum of numerator and denominator of a fraction is 8. If 3 is added to both the numerator and the denominator, then the fraction becomes $\frac{3}{4}$. Then, the fraction is :

(A) $\frac{1}{5}$ (B) $\frac{2}{5}$

(C) $\frac{3}{5}$ (D) $\frac{4}{5}$

Q.82 If the system of equations $3x + 4y = 12$ and $(m + n)x + 2(m - n)y = 5m - 1$ has infinite number of solutions, then the value of m and n are :

(A) $m = -5, n = -1$ (B) $m = 5, n = 1$

(C) $m = -1, n = 5$ (D) $m = n = 1$

Q.83 The value of k for which the system of equations $3x - 4y + 7 = 0$ and

$kx + 3y - 5 = 0$ has no solution is :

(A) $k = -\frac{9}{4}$ (B) $k = \frac{9}{4}$

(C) $k = \frac{4}{9}$ (D) $k = \frac{3}{17}$

Q.84 On solving the equations $ax + by = a - b$ and $bx - ay = a + b$, the values of x and y are:

(A) $x = -1, y = -1$ (B) $x = y = 1$

(C) $x = 1, y = -1$ (D) $x = -1, y = 1$

Q.85 In a ΔABC, $\angle C = 3$, $\angle B = 2(\angle A + \angle B)$.

The three angles are :

(A) $20^o, 40^o, 120^o$ (B) $30^o, 30^o, 120^o$

(C) $20^o, 60^o, 100^o$ (D) none of these

Q.86 On solving $0.2x + 0.5y = 3$ and

$0.5x + 0.2y = 3.3$ simultaneously, we get :

(A) $x = 4, y = 5$ (B) $x = 4, y = 4$

(C) $x = 5, y = 4$ (D) none of these

Q.87 Mother was asked how many gifts she had in bag. She replied that there were all dolls but six, and all books but six. How many gifts had she in all?

(A) 9 (B) 18

(C) 27 (D) 36

Q.88 In a diary, there are 60 cows and buffalos. The number of cows is twice that of buffalos. Buffalo X ranked seventeenth in terms of milk delivered. If there are 9 cows ahead of Buffalo X. How many buffalos are after in rank in terms of milk delivered?

(A) 10 (B) 11

(C) 12 (D) 13

Q.89 There are several human beings and several dogs in a room. One tenth of the human have lost a leg. The total numbers of feet are 77. Then, the number of dogs is

(A) 4 (B) 5

(C) 6

(D) Not determinable due to insufficient data

Q.90 Rs.1 and Rs.5 coins are available (as many required). Find hte smallest payment which cannot be made by these coins, if not more than 5 coins are allowed.

(A) 3 (B) 12

(C) 14 (D) 18

Q.91 Suppose you walk from home to the bus stand at 4 km/h and immediately return at x km/h. If the average speed is 6 km/h, then the value of x is

(A) 8 km/h

(B) 10 km/h

(C) 12 km/h

(D) Cannot be determined

ANSWER KEY

1.	A	**2.**	A	**3.**	A	**4.**	D
5.	B	**6.**	D	**7.**	C	**8.**	B
9.	C	**10.**	D	**11.**	B	**12.**	A
13.	C	**14.**	C	**15.**	C	**16.**	D
17.	C	**18.**	A	**19.**	A	**20.**	B
21.	C	**22.**	A	**23.**	D	**24.**	B
25.	C	**26.**	B	**27.**	A	**28.**	B
29.	D	**30.**	A	**31.**	D	**32.**	A
33.	B	**34.**	B	**35.**	C	**36.**	B
37.	D	**38.**	A	**39.**	B	**40.**	C
41.	B	**42.**	C	**43.**	A	**44.**	B
45.	D	**46.**	C	**47.**	B	**48.**	A
49.	B	**50.**	D	**51.**	D	**52.**	A
53.	A	**54.**	A	**55.**	A	**56.**	B
57.	B	**58.**	B	**59.**	C	**60.**	A
61.	A	**62.**	C	**63.**	A	**64.**	B
65.	A	**66.**	C	**67.**	B	**68.**	B
69.	B	**70.**	C	**71.**	A	**72.**	A
73.	D	**74.**	B	**75.**	B	**76.**	C
77.	A	**78.**	B	**79.**	C	**80.**	D
81.	C	**82.**	B	**83.**	A	**84.**	C
85.	A	**86.**	C	**87.**	A	**88.**	C
89.	B	**90.**	C	**91.**	C		